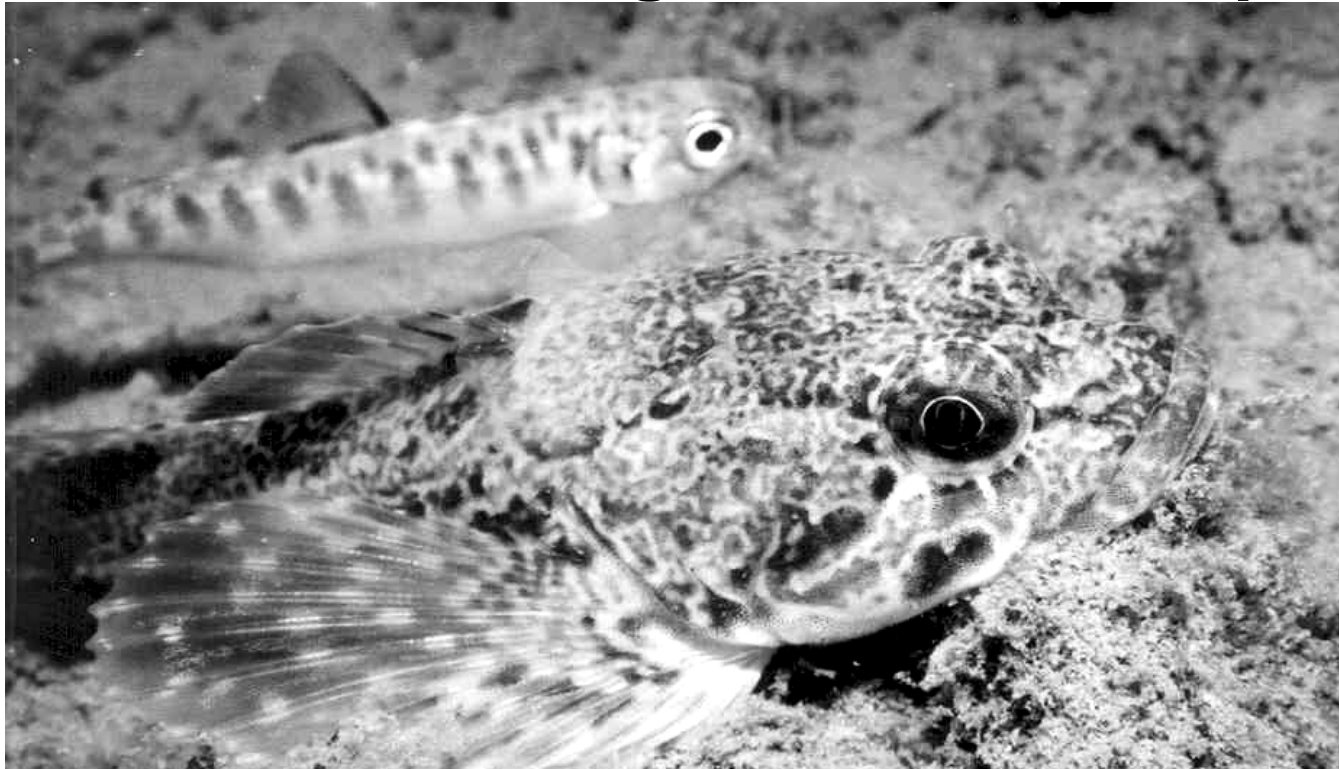


Synopsis of Predation on Juvenile Chinook Salmon by Predatory Fishes in the Cedar River, south Lake Washington, and the Ship Canal

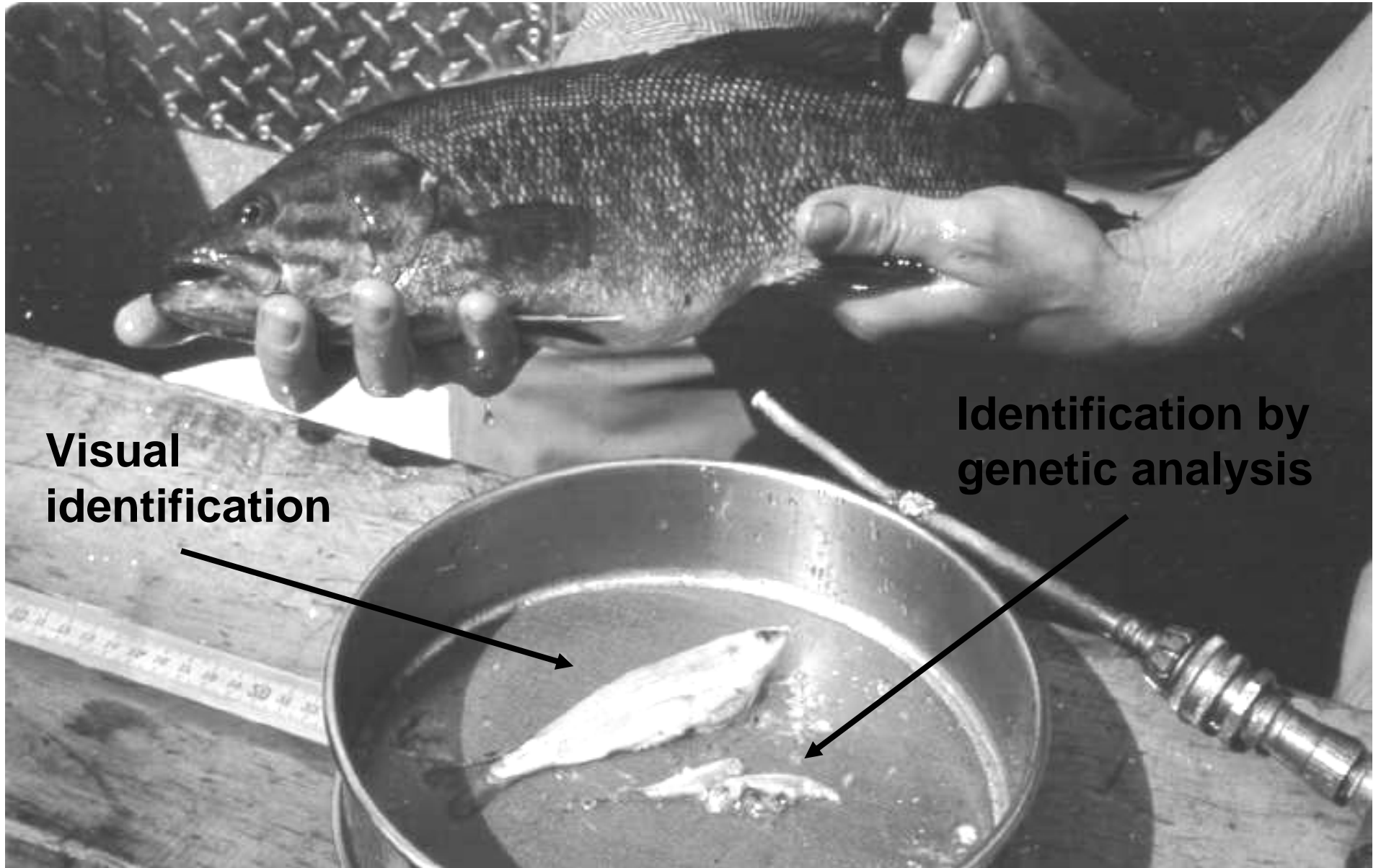


**Roger Tabor , Mark Celedonia, Francine Mejia, Rich Piaskowski, and
David Low, USFWS**

**Brian Footen, MIT; Linda Park, NOAA Fisheries
King County, USACOE, City of Renton**

Lake Washington Basin





**Visual
identification**

**Identification by
genetic analysis**

Objective

- **Use results of genetic analysis to complete 1999 and 2000 data from the Cedar River and Ship Canal**
- **Review existing data that originally focused on predation of sockeye**

Methodology

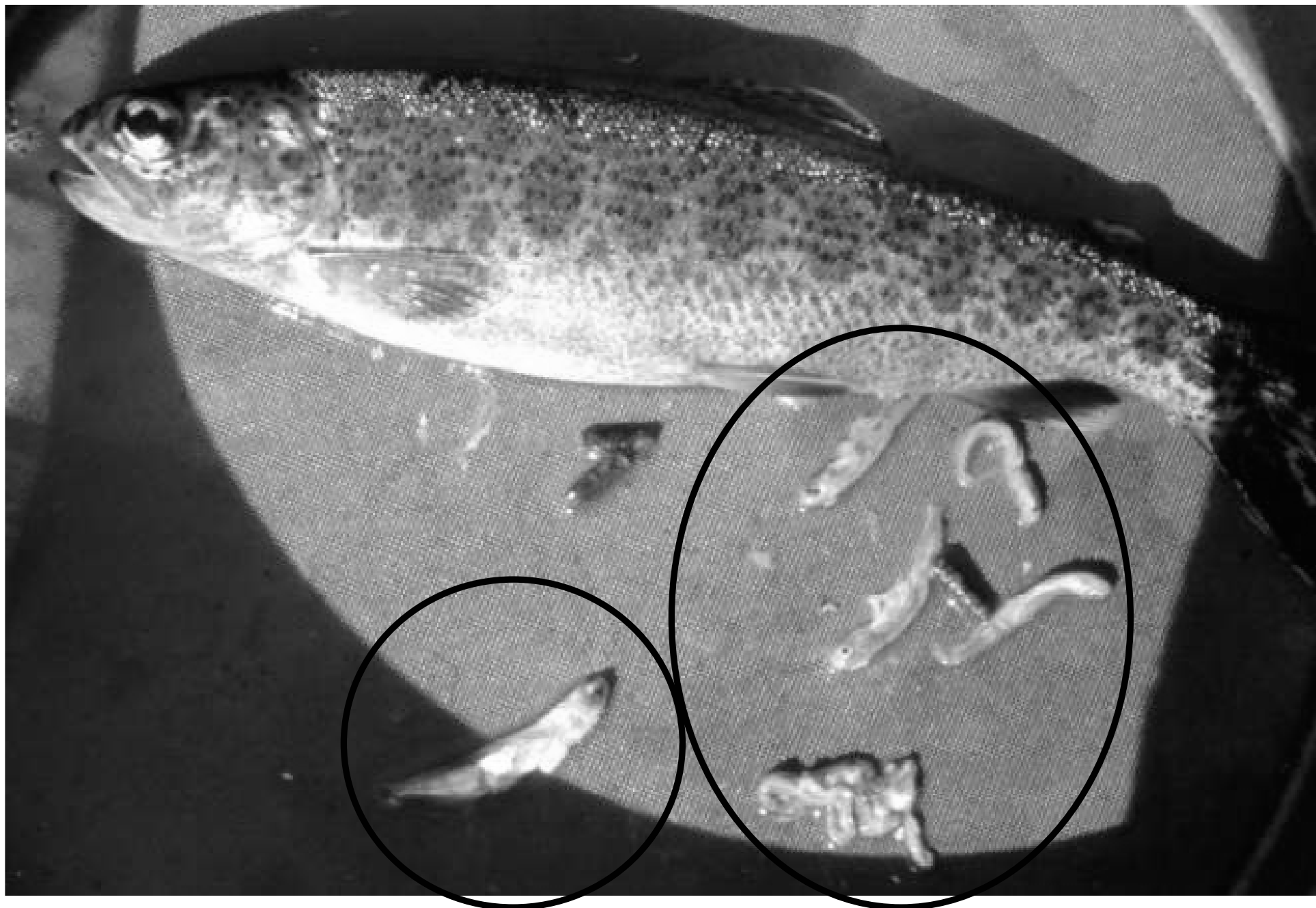
- **Fish collections – primarily electrofishing**
- **Gastric flushing**
- **Diet analysis including size of prey fish**
- **Population estimates**
- **Consumption rates**
 - **Bioenergetics model**
 - **Meal turnover model – Adams model**
- **Growth rates and water temperatures**

Lower Cedar River



Lower Cedar River

- **Entire study area sampled in 1998 and 2000 (January-April); lower 1.7 km sampled 1995-2000 (February-June)**
- **Fish collected primarily by backpack electrofishing**
- **Population sizes**
 - **Salmonids: night snorkel counts**
 - **Sculpin: based on mark-recapture efforts**
- **Habitat based model**

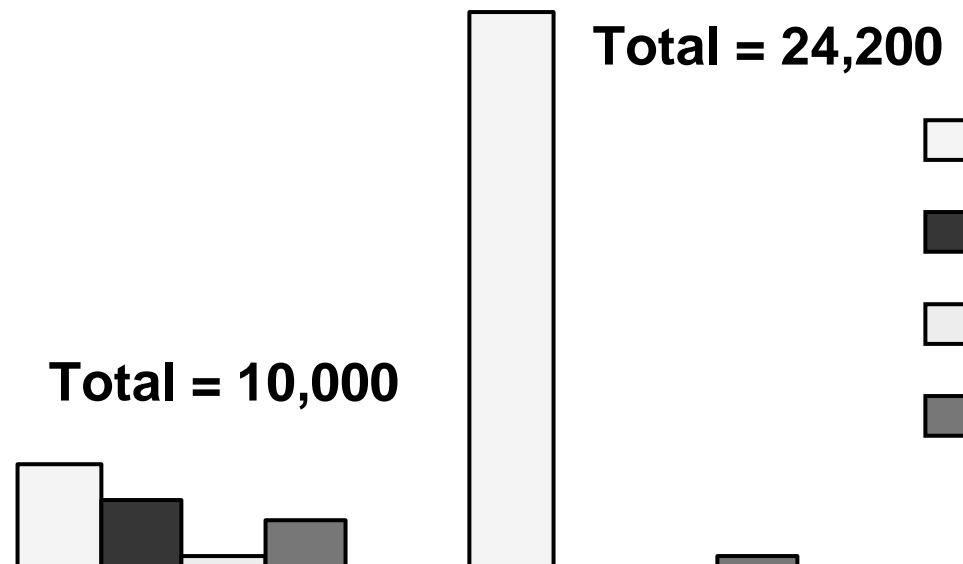


Predator species

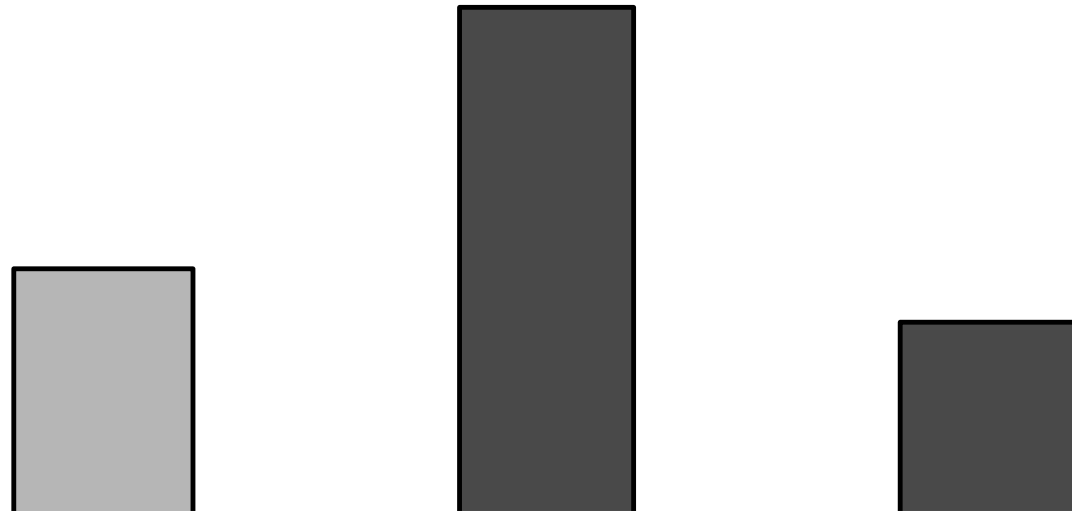
Species	N	Chinook
Salmonids		
Coho salmon	526	3
Cutthroat trout	374	15
Rainbow trout / steelhead	616	11
Cottids		
Coastrange sculpin	767	0
Prickly sculpin	2,388	3
Riffle sculpin	778	0
Torrent sculpin	1,425	9

Consumption estimates

Bioenergetics model



Comparison of predation and number of migrants, 2000



Migrant data from D. Seiler, WDFW

Prey size / Predator size

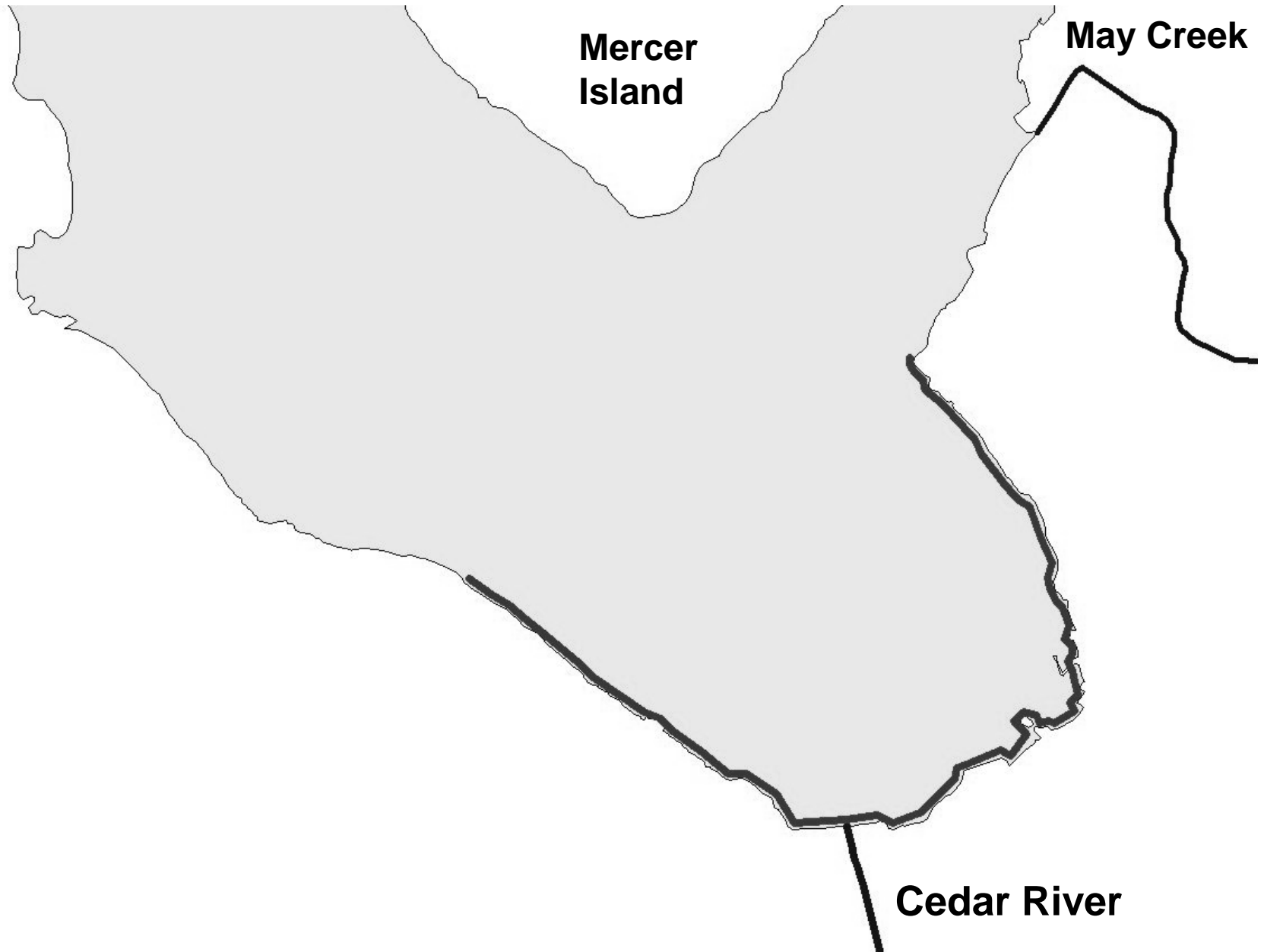
South Lake Washington



South Lake Washington

- **Sampling conducted February-June, 1995-1997**
- **Fish collected primarily by boat electrofishing**
- **Population sizes**
 - **Salmonids: single mark-recapture, May 1995**
 - **Sculpin: based on backpack electrofishing catch per effort by substrate type, 1997**
 - **Bass: multiple mark-recapture, 1995**

South Lake Washington study area



Juvenile Chinook Abundance

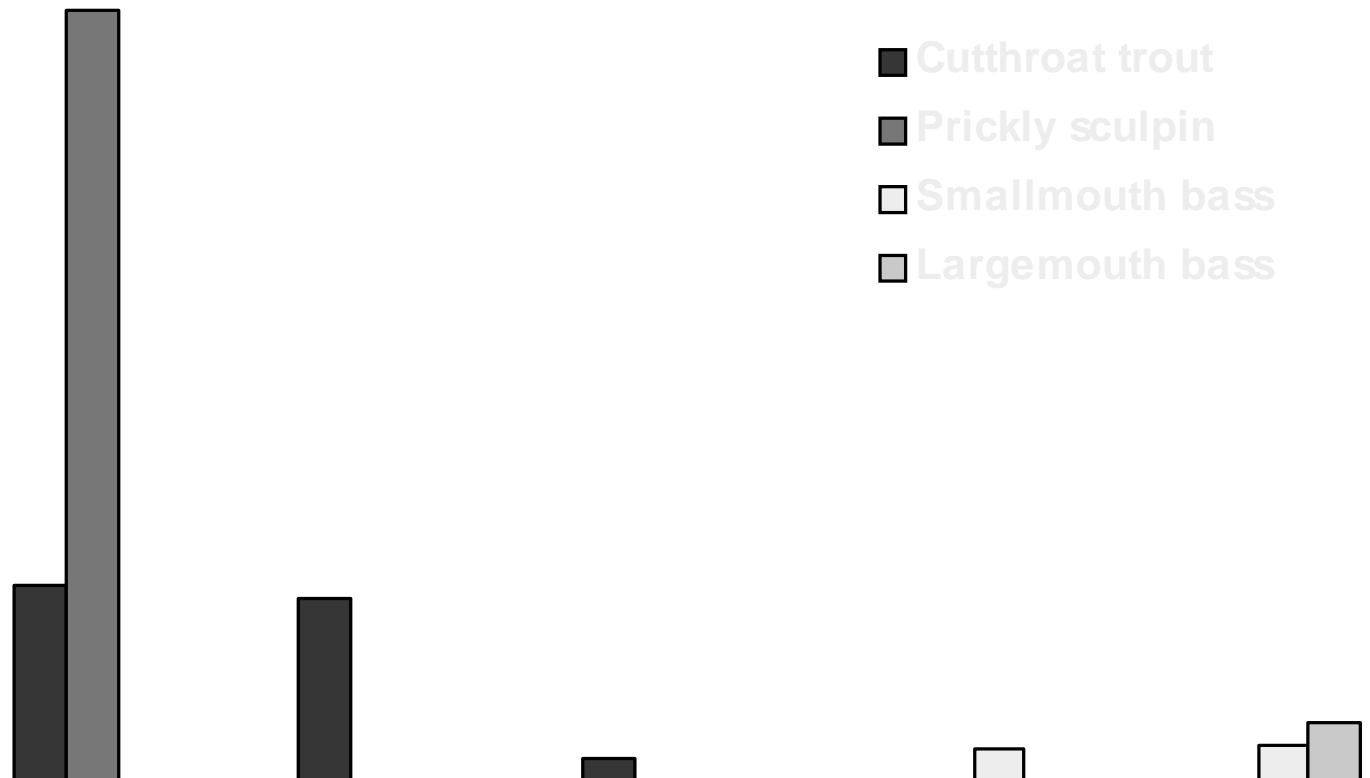
South Lake Washington, Feb-May, 2003



Predator species

Species	N	Chinook
Coho salmon	190	0
Cutthroat trout	391	8
Rainbow trout / steelhead	283	0
Northern pikeminnow	77	0
Prickly sculpin	377	1
Smallmouth bass	258	5
Largemouth bass	35	1
Yellow perch	182	0

Consumption estimates



Total consumption = 1,519 Chinook

Lake Washington Ship Canal



Ship Canal

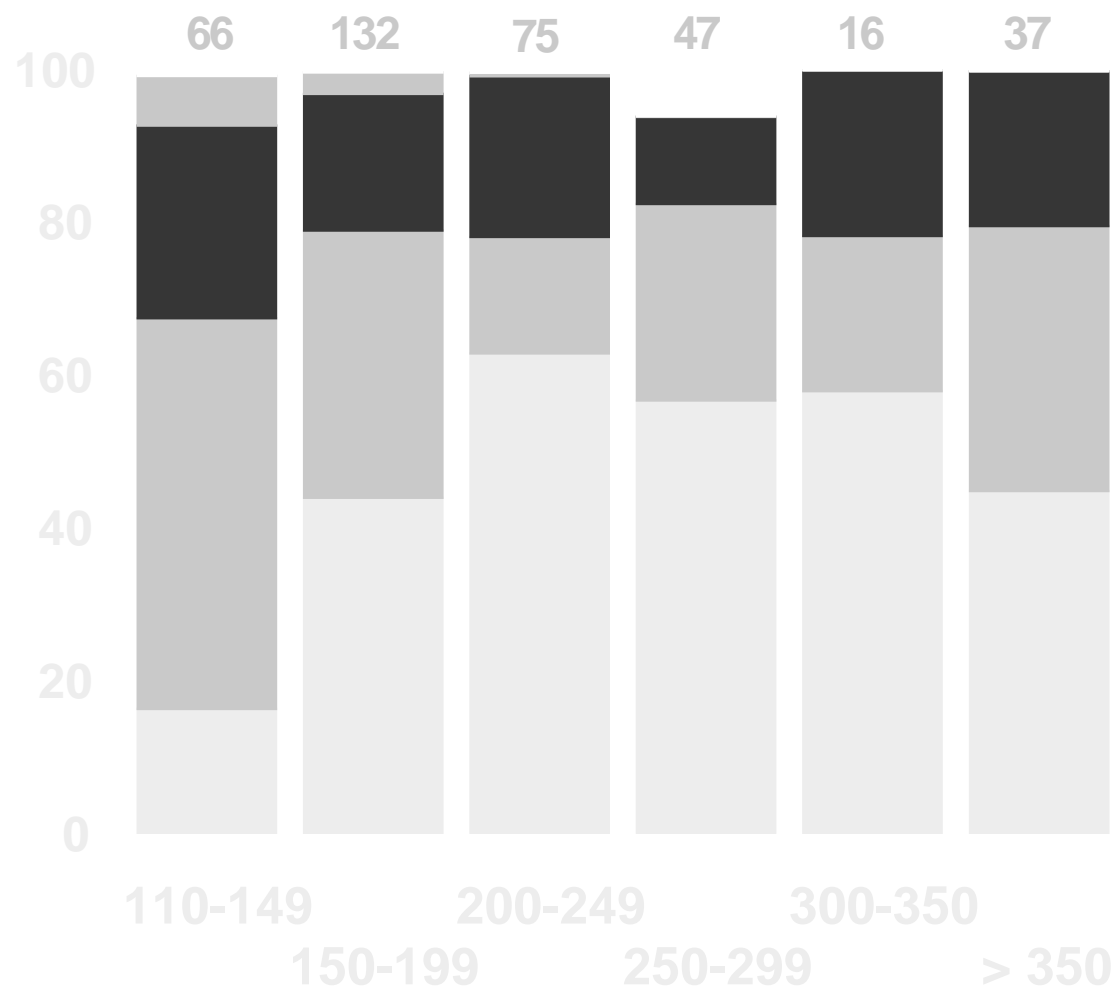
- **Sampling conducted late April-July, 1999**
- **Fish collected by boat electrofishing**
- **Population sizes**
 - **Bass: multiple mark-recapture, 1999**
 - **Pikeminnow – no population estimate**

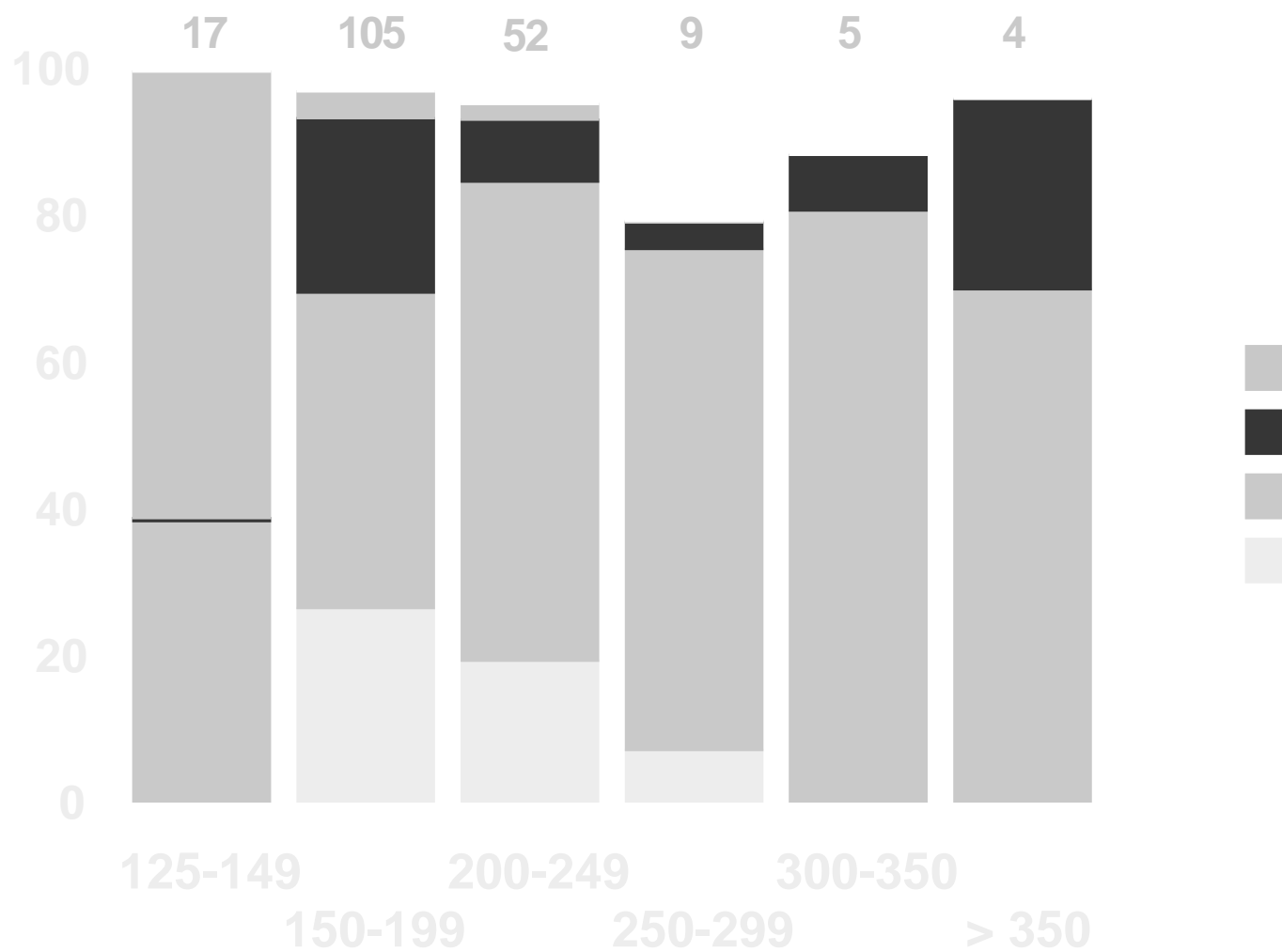


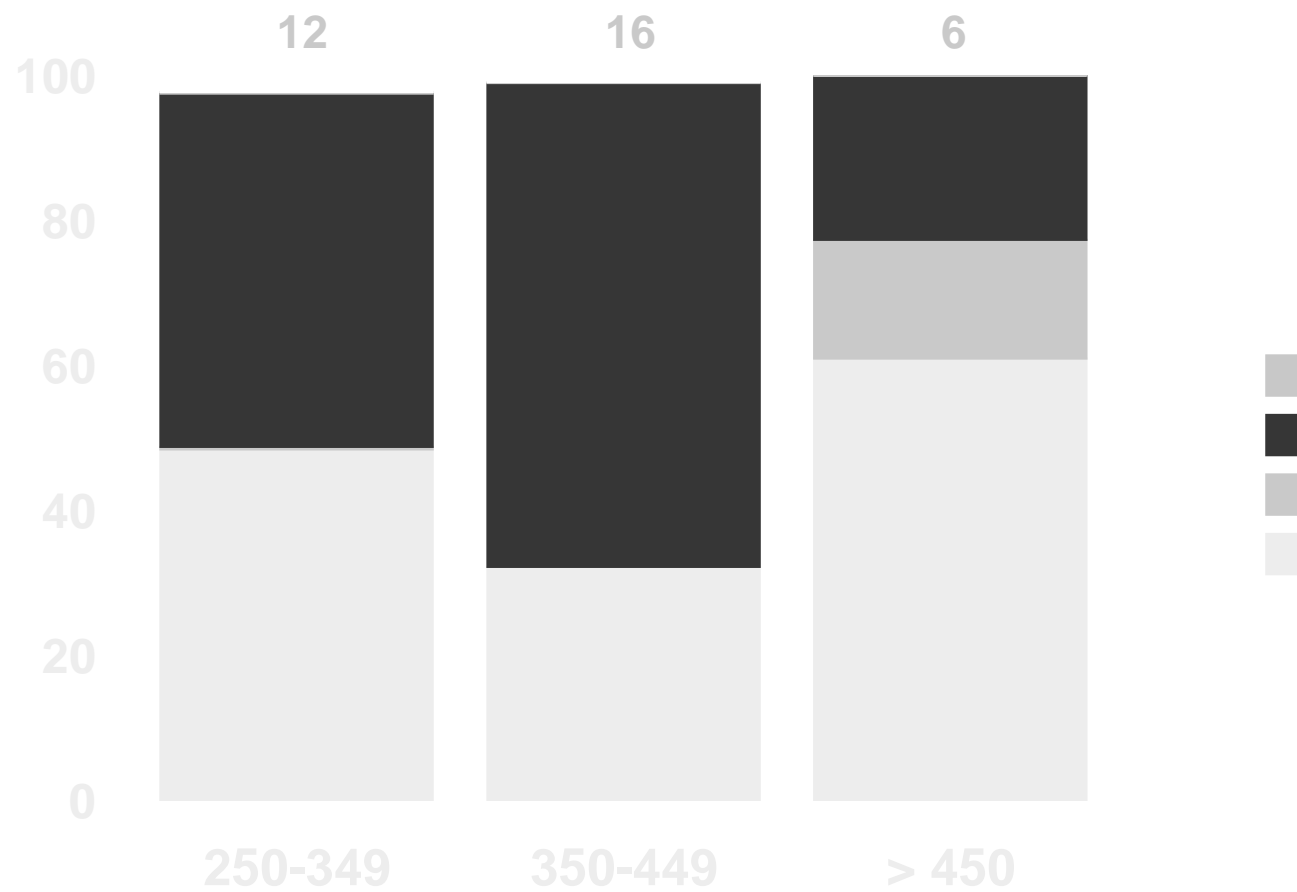
Ship Canal Sample Areas, 1999

Predator species

Species	N	Smolts
Cutthroat trout	50	0
Northern pikeminnow	52	20
Brown bullhead	22	0
Smallmouth bass	508	158
Largemouth bass	280	32

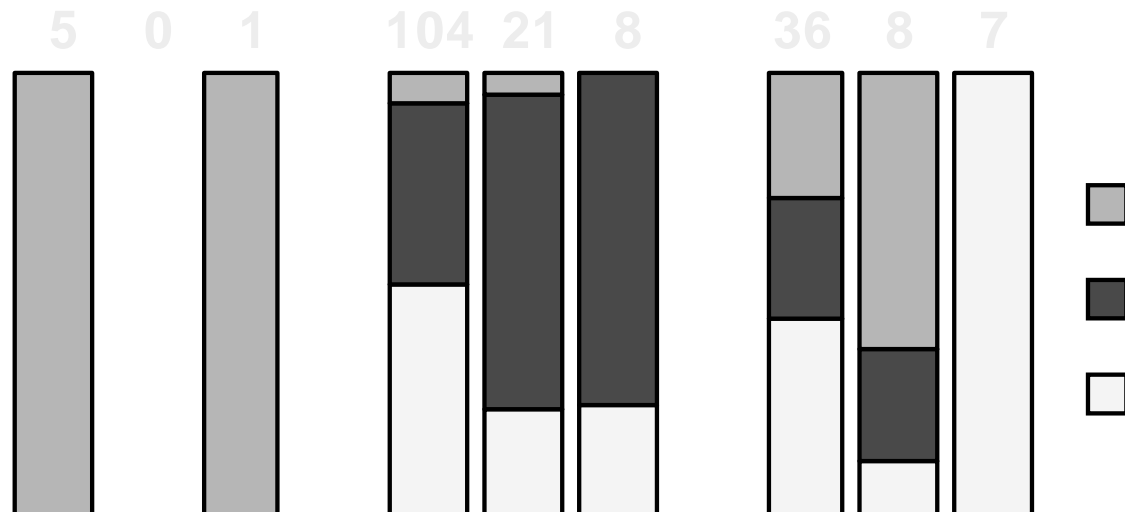




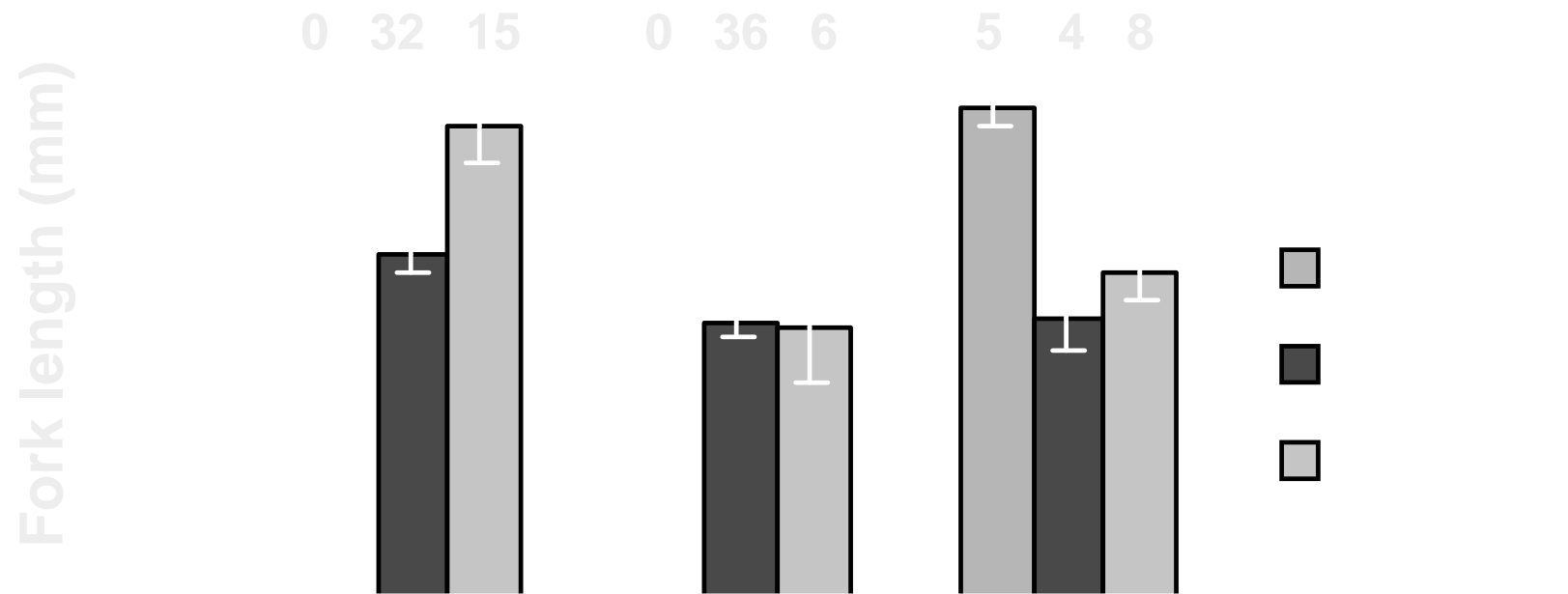


Salmonid species consumed

Identified 90% (190 of 210) of smolts to species

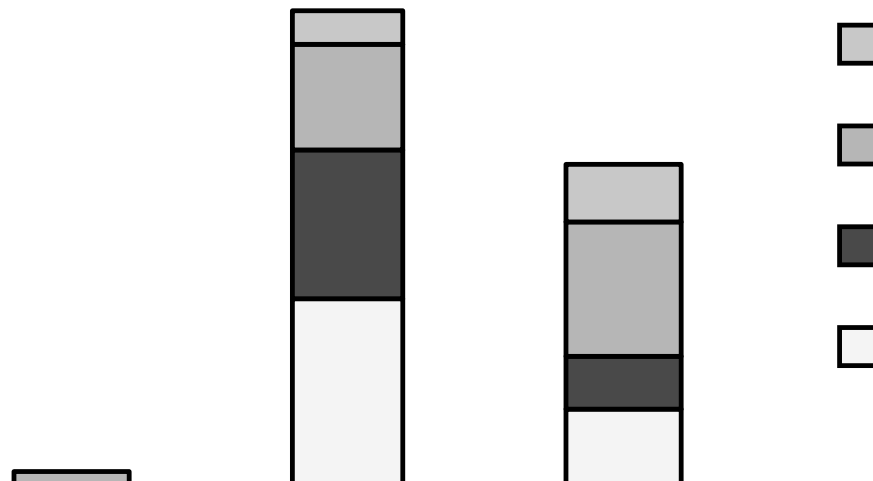


Fork length of ingested salmonids



Smallmouth bass consumption

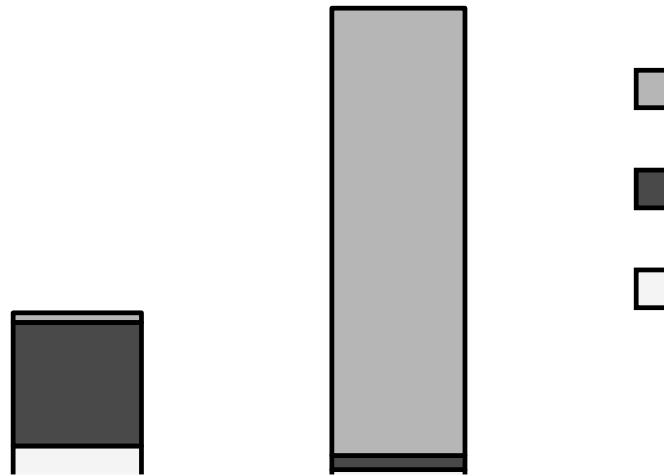
Bioenergetics model



Total consumption = 27,300 smolts (bioenergetics model)
= 41,100 smolts (meal turnover model)

Largemouth bass consumption

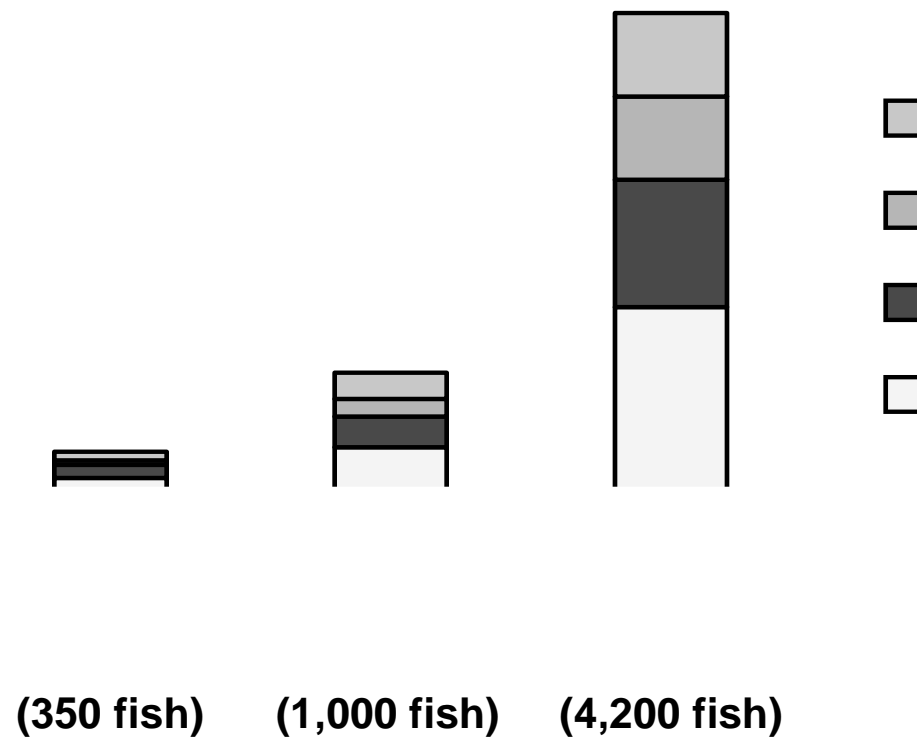
Bioenergetics model



Total consumption = 8,700 smolts (bioenergetics model)
= 4,600 smolts (meal turnover model)

Northern pikeminnow consumption

Bioenergetics model



Conclusions

- Genetic analysis greatly improved our consumption estimates
- Rainbow trout and cutthroat trout were the most important predators of Chinook in the Cedar River and may consume over 25% of the juvenile Chinook

Conclusions, cont'd

- The main predators of Chinook in south Lake Washington were prickly sculpin, cutthroat trout, and smallmouth bass
- Consumption estimates indicate predatory fishes consumed less than 10% of the early migrants in south Lake Washington

Conclusions, cont'd

- Smallmouth bass in the Ship Canal appeared to consume equal numbers of coho, sockeye, and Chinook
- Smallmouth bass probably consumed less than 1% of the Chinook in the Ship Canal
- Northern pikeminnow may be an important predator if their population is large